



Data User Guide

GPM Ground Validation Rain Gauges NASA ACHIEVE IPHEX

Introduction

The GPM Ground Validation Rain Gauges NASA ACHIEVE IPHEX dataset was gathered during the GPM Ground Validation Integrated Precipitation and Hydrology Experiment (IPHEX) in North Carolina from May 9, 2014 through June 14, 2014. This dataset includes data from the Optical Scientific Optical Rain Gauge instrument and Novalynx Tipping Bucket Rain Gauge instrument which are both part of the NASA Goddard Space Flight Center (GSFC) ACHIEVE ground-based mobile laboratory. The optical rain gauge obtains high sensitivity optical measurements for precipitation rate and quantity, as well as measures 24-hour cumulative precipitation, precipitation rate, and temperature. The tipping bucket rain gauge is a standard tipping bucket rain gauge that measures 24-hour cumulative precipitation. Data files are available in netCDF-3 format.

Citation

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Keywords:

NASA, GHRC, GSFC, ACHIEVE, IPHEX, North Carolina, optical rain gauge, tipping bucket rain gauge, precipitation rate, temperature, cumulative precipitation

Campaign

The Global Precipitation Measurement (GPM) mission Ground Validation campaign used a variety of methods for validation of GPM satellite constellation measurements prior to and after launch of the GPM Core Satellite, which launched on February 27, 2014. The instrument validation effort included numerous GPM-specific and joint agency/international external field campaigns, using state of the art cloud and

precipitation observational infrastructure (polarimetric radars, profilers, rain gauges, and disdrometers). These field campaigns accounted for the majority of the effort and resources expended by GPM GV. More information about the GPM mission is available at <https://pmm.nasa.gov/GPM/>.

One of the GPM Ground Validation field campaigns was the Integrated Precipitation and Hydrology Experiment (IPHEX) which was held in North Carolina during 2013 and 2014 with an intense study period from May 1 to June 15, 2014. The goal of IPHEX was to characterize warm season orographic precipitation regimes and the relationship between precipitation regimes and hydrologic processes in regions of complex terrain. The IPHEX campaign was part of the development, evaluation, and improvement of remote-sensing precipitation algorithms in support of the GPM mission through NASA GPM Ground Validation field campaign (IPHEX_GVFC) and the evaluation of Quantitative Precipitation Estimation (QPE) products for hydrologic forecasting and water resource applications in the Upper Tennessee, Catawba-Santee, Yadkin-Pee Dee, and Savannah river basins (IPHEX-HAP, H4SE). NOAA Hydrometeorology Testbed (HTM) has synergy with this project. More information about IPHEX is available at <https://pmm.nasa.gov/IPHEX> and <http://dx.doi.org/10.5067/GPMGV/IPHEX/DATA101>.

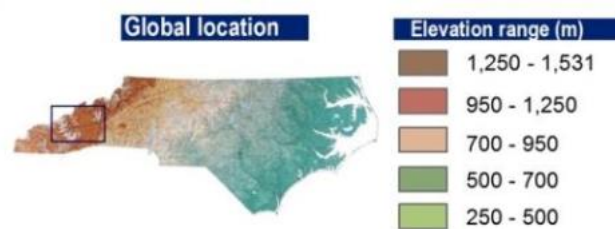


Figure 1: Region of North Carolina IPHEX campaign ground validation
(image source: <http://gpm-gv.gsfc.nasa.gov/Gauge/>)

Instrument Description

The Optical Scientific Rain Gauge and the Novalynx Tipping Bucket Rain Gauge instruments were used to collect this dataset located at 35.520, -83.095. The Optical Scientific Rain Gauge measured rainfall by detecting the optical irregularities induced within the sample volume by precipitating particles falling through a beam of infrared light. The rainfall rate can be measured by detecting the intensity of the particles falling through the infrared light. More information about the Optical Scientific Rain Gauge can be found in the [Optical Rain Gauge Instrument Handbook](#).

The Novalynx Tipping Bucket Rain Gauge is designed to allow unlimited measurements of rainfall. As each tip of the bucket counts the rain, the water is dumped out of the bucket and it exits the gauge through drains located in the base plate. This rain gauge is calibrated to product switch contacts for every 0.01 inches of rainfall counting each bucket tip. More information about the Novalynx Tipping Bucket Rain Gauge is available in the [Novalynx Users Manual](#).

Investigators

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Data Characteristics

The GPM Ground Validation Rain Gauges NASA ACHIEVE IPHEX dataset files are available in netCDF-3 format which consists of rain accumulation, rainfall rate, and temperature measurements. These data were collected from May 1, 2014 through June 15, 2014 and are a Level 1B processing level. More information about the NASA data processing levels are available on the [NASA Data Processing Levels website](#). Table 1 shows the characteristics of the data files.

Table 1: Data Characteristics

Characteristic	Description
Platform	Ground station
Instrument	Optical Scientific Rain Gauge and Novalynx Tipping Bucket Rain Gauge
Projection	n/a
Spatial Coverage	N: 35.52, S: 35.51, E: -83.08, W: -83.10 (North Carolina)
Spatial Resolution	point
Temporal Coverage	May 1, 2014 - June 15, 2014
Temporal Resolution	daily
Sampling Frequency	<1 second
Parameter	Rain accumulation, rainfall rate, temperature
Version	1
Processing Level	1B

File Naming Convention

The GPM Ground Validation Rain Gauges NASA ACHIEVE IPHEX data are named with the following naming convention:

Data files: IPHEX_[ORG815|TRG260]_raingauge_YYYYMMDD.L1b.nc

Table 2: File naming convention variables

Variable	Description
[ORG815 TRG260]	ORG815: Optical Scientific Rain Gauge TRG260: Novalynx Tipping Bucket Rain Gauge
YYYY	Four-digit year
MM	Two-digit month
DD	Two-digit day
.nc	netCDF-3 data format

Data Format and Parameters

The GPM Ground Validation Rain Gauges NASA ACHIEVE IPHEX dataset consists of rain accumulation, rainfall rate, and temperature measurements. These data are available in netCDF-3 data format. There are data files for each rain gauge instrument: ORG815 for the Optical Scientific Rain Gauge and TRG260 for the Novalynx Tipping Bucket Rain Gauge. Table 3 lists and describes the parameters in the ORG815 data files, while Table 4 lists and describes the parameters in the TRG260 data files.

Table 3: Data Fields in ORG815 files

Field Name	Description	Data Type	Unit
DOY	Julian Day	float	-
frac_day	Fractional day	float	-
rain_accum	Cumulative precipitation since midnight UTC	float	mm
rain_rate	Precipitation rate	float	mm/hr
temp	temperature	float	Degrees Celsius
time	Serial Date	double	UTC
weather	Weather code: 0=no precip 1= R- (light rain) 2= R (rain) 3= R+ (heavy rain)	float	-
year	Year	float	-

Table 3: Data Fields in TRG260 files

Field Name	Description	Data Type	Unit
DOY	Julian Day	float	-
frac_day	Fractional day	float	-
rain_accum	Cumulative precipitation since midnight UTC	float	mm
time	Serial Date	double	UTC

voltage_batt	Battery voltage	float	V
year	Year	float	-

Quality Assessment

The Novalynx Tipping Bucket Rain Gauge has a reported accuracy of $\pm 1\%$ for 1 to 3 inches per hour and $\pm 3\%$ for 0 to 6 inches per hour. The Optical Scientific Rain Gauge has a reported accuracy of $\pm 5\%$ of observed intensity over a range from 0.1 to 500 mm/hr. More information about the quality and accuracy of these data can be found in the [Optical Rain Gauge Instrument Handbook](#) and in the [Novalynx Users Manual](#).

Software

These data are available in netCDF-3 format, so no software is required to view these data. However, [Panoply](#) can be used to easily view these data.

Known Issues or Missing Data

Data values of -9999.9 are considered to be missing data.

References

Bartholomew, M. J.(2016). Optical Rain Gauge Instrument Handbook.
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Wang, Jianxin and David B. Wolff. (2010). Evaluation of TRMM Ground-Validation Radar-Rain Errors Using Rain Gauge Measurements. *Journal of Applied Meteorology and Climatology*, 49, 310-324. doi: <https://doi.org/10.1175/2009JAMC2264.1>

Related Data

All data from other instruments collected during the IPHEX field campaign are related to this dataset. Other IPHEX campaign data can be located using the GHRC HyDRO 2.0 search tool.

In addition, other data that used rain gauges in previous GPM Ground Validation campaigns are also related data. The following datasets are a couple of datasets that used rain gauges to collect data. The full list can be found using the GHRC HyDRO 2.0 search tool.

GPM Ground Validation Rain Gauge Pairs MC3E V2

(<http://dx.doi.org/10.5067/GPMGV/MC3E/GAUGE/DATA202>)

GPM Ground Validation Met One Rain Gauge Pairs IFloodS V2

(<http://dx.doi.org/10.5067/GPMGV/IFLOODS/GAUGE/DATA202>)

GPM Ground Validation Iowa Flood Center (IFC) Rain Gauges IFloodS

(<http://dx.doi.org/10.5067/GPMGV/IFLOODS/GAUGES/DATA/101>)

GPM Ground Validation Met One Rain Gauge Pairs OLYMPEX

(<http://dx.doi.org/10.5067/GPMGV/OLYMPEX/GAUGES/DATA201>)

Contact Information

To order these data or for further information, please contact:

NASA Global Hydrology Resource Center DAAC

User Services

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